

6. GLOSSARY OF TERMS

Absolute Bioavailability (or ABA): Conventionally expressed as the fraction of the externally administered amount of a metal substance that is absorbed and reaches the systemic circulation or central compartment of the receptor.

Acclimation: How an individual organism develops tolerance during its lifetime, and it may be gained or lost. Acclimation is also called ***phenotypic plasticity***.

Adaptation: A genetic change over multiple generations as a response to natural selection. Traits are not lost during single life times. Adaptation is also known as ***genotypic plasticity***.

Additivity: When the effect of the combination is estimated by the sum of the exposure levels or the effects of the individual components.

Adsorption: Adsorption is the adhesion of molecules of gas, liquid, or dissolved solids to a surface.

Antagonism: When the effect of the combination is less than that suggested by the component toxic effects.

Background: The amount of metals occurring in soils, water, or air as a result of anthropogenic and natural processes.

Bioaccessibility: The portion of total metal in soil, sediment, water, or air that is available for physical, chemical, and biological modifying influences (e.g., fate, transport, bioaccumulation) is termed the environmentally available fraction. Also referred to as ***Environmental Availability***.

Bioaccumulation: The net accumulation of a metal in tissue of interest or the whole organisms that results from exposure from all environmental sources, including air, water, solid phases (i.e., soil, sediment), and diet, and representing a steady-state balance of losses from tissue and the body.

Bioaccumulation Factor (or BAF): The ratio of the metal concentration in an organism to that in the surrounding medium at steady state. Metal accumulation in organisms is derived from all routes of exposure.

Bioconcentration Factor (or BCF): The ratio of metal concentration in an aquatic organism to the metal concentration in water at steady state. Metal accumulation in aquatic organisms is derived from water only.

Bioavailability of Metals: The extent to which bioaccessible metals adsorb onto or absorb into

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and across biological membranes of organisms, expressed as a fraction of the total amount of metal the organism is proximately exposed to (at the sorption surface) during a given time and under defined conditions.

Biomagnification: The tendency of a chemical to accumulate to higher concentrations at higher levels in the trophic system through dietary accumulation.

Biomarker: Biochemical, physiological, and histological changes in organisms that can be used to estimate either exposure to chemicals or the effects of exposure to chemicals.

Biomonitoring: Use of living organisms as "sensors" in environmental quality surveillance to detect changes in environmental conditions that might threaten living organisms in the environment.

Cation Exchange Capacity (CEC): A measure of the soil's ability to adsorb or release cations, which is proportional to the number of available, negatively charged sites. The CEC is one of the important parameters in controlling the potential bioavailability of metals in soils.

Community: An assemblage of populations of different species within a specified location in space and time.

Conceptual model: A conceptual model in problem formulation is a written description and visual representation of predicted relationships between ecological entities and the stressors to which they may be exposed.

Delft 3D model: Software package that simulates two- and three-dimensional flow, waves, water quality, ecology, sediment transport, and bottom morphology.

Donald J. O'Connor model: Algorithms for inclusion in the Simplified Lake and Stream Analysis [SLSA] model.

Dose: The amount of a substance available for interaction with metabolic processes or biologically significant receptors after crossing the outer boundary of an organism. The potential dose is the amount ingested, inhaled, or applied to the skin. The applied dose is the amount of a substance presented to an absorption barrier and available for absorption (although not necessarily having yet crossed the outer boundary of the organism). The absorbed dose is the amount crossing a specific absorption barrier (e.g., the exchange boundaries of skin, lung, and digestive tract) through uptake processes. Internal dose is a more general term denoting the amount absorbed without respect to specific absorption barriers or exchange boundaries. The amount of the chemical available for interaction by any particular organ or cell is termed the delivered dose for that organ or

Dose-response Curve: A graphical representation of the quantitative relationship between

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administered, applied, or internal dose of a chemical or agent, and a specific biological response to that chemical or

Dose-Response Relationship: The relationship between a quantified exposure (dose) and the proportion of subjects demonstrating specific biologically significant changes in incidence and/or in degree of change (response).

EC₅₀: A statistically or graphically estimated concentration that is expected to cause one or more specified effects in 50% of a group of organisms under specified conditions (1996). (Pertains to ecological assessments)

Ecosystem: All the living (e.g., plants, animals, and humans) and nonliving (rocks, sediments, soil, water, and air) material interacting within a specified location in time and space.

Endpoint: A measured response of a receptor to a stressor. An endpoint can be measured in a toxicity test or in a field survey.

Environmental Availability: See ***Bioaccessibility***.

Essential Metals: Trace metals present in all healthy tissue of humans, whereby their withdrawal from the body induces physiological, biochemical, and structural abnormalities and their addition either reverses or prevents these abnormalities.

Exposure: Contact of a pollutant with the outer boundary of an organism; exposure is quantified as the concentration of the agent in the medium over time.

Exposure Pathway: The course a chemical or physical agent takes from a source to an exposed organism. An exposure pathway describes a unique mechanism by which an individual or population is exposed to chemicals or physical agents at or originating from a site.

Exposure Route: The mechanism for which a chemical or physical agent comes in contact with a person (e.g., by ingestion, inhalation, dermal contact).

Fugacity: Tendency for a metal to transfer from one medium to another.

Ground Water: Water in a saturated zone or stratum beneath the surface or land or water.

HST3D model: A 3-Dimensional ground water flow, heat and solute transport model.

HYDRAQL model: Computer-based speciation model.

Hydrophilic: Denoting the property of attracting or associating with water molecules; characteristic of polar or charged molecules.

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Hydrophobic: With regard to a molecule or side group, tending to dissolve readily in organic solvents, but not in water, resisting wetting, not containing polar groups or sub-groups.

Indirect Effects: Changes in a resource that are due to a series of cause-effect relationships rather than to direct exposure to a contaminant or other stressor. As a consequence of potential direct effects of metals on organisms (e.g., mortality, reduced fecundity), other organisms in the community can be indirectly affected (e.g., reduced prey items, predators).

Inhibition: When one substance does not have a toxic effect on a certain organ system, but when added to a toxic chemical, it makes the latter less toxic.

Integrated Risk Information System (IRIS): IRIS is an electronic database that contains EPA's latest descriptive and quantitative regulatory information about chemical constituents. Files on chemicals maintained in IRIS contain information related to both noncarcinogenic and carcinogenic health effects.

LC₅₀: A statistically or graphically estimated concentration that is expected to be lethal to 50% of a group of organisms under specified conditions

Margin of Exposure: The ratio of the critical NOAEL to the expected human exposure level.

Mechanism of Action: The complete sequence of biological events that must occur to produce a toxic effect.

Metal and Metalloid: An element that acts as a cation in chemical reactions, forms a base with the hydroxyl radical, and can replace the hydrogen of an acid to form a salt. Antimony, arsenic, molybdenum, selenium, and vanadium generally occur as oxyanions in waters and soils, and not as cations. These elements are sometimes described as *metalloids*.

MIKE21 model: Modeling tool for rivers, estuaries, and coastal waters for two-dimensional free-surface flows.

MINTEQ model: Computer-based speciation model for modeling metal partitioning in discharge; the model usually must be run in connection with another fate and transport model.

MINEQL model: Computer-based speciation model.

MINTEQA2 model: An equilibrium speciation model that can be used to calculate the equilibrium composition of dilute aqueous solutions in the laboratory or in natural aqueous systems (updates MINTEQ).

Mode of Action: A less-detailed description of the mechanism of action in which some, but not all, of the sequence of biological events leading to a toxic effect is known.

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NICA model: Non-Ideal Competitive Absorption model. Computer program for studies of metals in soil moisture.

Nonthreshold Effect: An effect for which it is assumed that there is no dose, no matter how low, for which the probability of an individual's responding is zero.

Organometallics: Compounds that have a metal/metalloid-carbon bond.

Physiologically-Based Pharmacokinetic (PBPK) Model: A model that estimates the dose to a target tissue or organ by taking into account the rate of absorption into the body, distribution between target organs and tissues, metabolism, and excretion.

PHREEQC model: Speciation and reaction path calculations for freshwaters and brines.

Pollution-Induced Community Tolerance (or PICT): A tool to assess effects of pollutants on ecological communities by comparing responses of communities collected from polluted and reference sites to contaminant exposures under controlled conditions. An increase in community tolerance at a polluted site that results from the elimination of sensitive species is considered evidence that this restructuring was caused by the pollutant.

Receptors: Organisms, populations, or ecosystems that are exposed to a contaminant or other stressor.

Recommended Dietary Allowance (or RDA): The dietary level of intake of essential nutrients considered to be adequate to meet the known nutritional

REDEQL2 model: Chemical reaction model; computer programs [REDEQL and MINEQL series] to calculate chemical equilibrium in complex systems, including natural waters and manmade chemical systems.

Reference Site: A relatively uncontaminated site used for comparison to contaminated sites in environmental monitoring studies, often incorrectly referred to as a control.

RESRAD model: Family of computer risk codes developed to calculate site-specific RESidual RADioactive material guidelines as well as radiation dose and excess lifetime cancer risk to a chronically exposed on-site resident.

Reference Concentration (or RfC): An estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. It can be derived from a NOAEL, LOAEL, or benchmark concentration, with uncertainty factors generally applied to reflect limitations of the data used.

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Reference Dose (or RfD): An estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. It can be derived from a NOAEL, LOAEL, or benchmark dose, with uncertainty factors generally applied to reflect limitations of the data used.

Regression Analysis: Analysis of the functional relationship between two variables; the independent variable is described on the X axis and the dependent variable is described on the Y axis (i.e. the change in Y is a function of a change in X).

Relative Absorption Factor (or RAF): Similar to the RBA, the RAF more specifically refers to the fraction or percentage of a metal that is absorbed across a biological membrane. The RAF is one of the more common measures of uptake of metals into the body from environmental exposure media.

Relative Bioavailability (or RBA): The ratio (fraction or percentage) of the amount of a metal substance of interest that is adsorbed or absorbed under defined conditions (e.g., metal salt type, specified vehicle or matrix, differing test doses, different physiological states of the receptor) as compared to a reference metal substance tested under standard conditions.

Risk: The expected frequency or probability of undesirable effects resulting from exposure to known or expected stressors.

Risk Assessment: Qualitative or quantitative evaluation of the risk posed to human health and/or the environment by the actual or potential presence or release of hazardous substances, pollutants or contaminants.

Risk Characterization: A phase of risk assessment that integrates the results of the exposure and effects analyses to evaluate the likelihood of adverse effects associated with exposure to the stressor. The ecological significance of the adverse effects is discussed, including consideration of the types and magnitudes of the effects, their spatial and temporal patterns, and the likelihood of recovery.

Secondary Effect: An effect where the stressor acts on supporting components of the ecosystem, which in turn have an effect on the ecological component of interest (synonymous with indirect effects; compare with definition for primary effect).

Sediment: Particulate material lying below water.

Simultaneously extracted metals (SEM): Divalent metals, commonly cadmium, copper, lead, mercury, nickel, and zinc, that form less soluble sulfides than do iron or manganese and are solubilized during the acidification step (0.5M HCl for 1 hour) used in the determination of acid volatile sulfides in sediments.

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Speciation: Refers to the distribution of an element among defined chemical species, which are the specific form of an element defined as to isotopic composition, electronic or oxidation state, and/or complex or molecular structure.

Stressor: Any physical, chemical, biological entity that can induce an adverse

Synergism: When the effect of the combination is greater than that suggested by the component toxic effects.

Susceptibility: Increased likelihood of an adverse effect, often discussed in terms of relationship to a factor that can be used to describe a human subpopulation (e.g. life stage, demographic feature, or genetic characteristic).

Surface Water: Surface water is all water naturally open to the atmosphere, such as rivers, lakes, reservoirs, streams, and seas.

Susceptible Subgroups: May refer to life stages, for example, children or the elderly, or to other segments of the population, for example, asthmatics or the immune-compromised, but are likely to be somewhat chemical-specific and may not be consistently defined in all cases.

Threshold Effect: An effect for which there is some dose below which the probability of an individual's responding is zero.

Tolerance: The ability of an organism to maintain homeostasis under a variety of environmental conditions, such as variable metal concentrations.

Toxicity: Deleterious or adverse biological effects elicited by a chemical, physical, or biological agent.

Toxicodynamics: The determination and quantification of the sequence of events at the cellular and molecular levels leading to a toxic response to an environmental agent (also called pharmacodynamics).

Toxicokinetics: The determination and quantification of the time course of absorption, distribution, biotransformation, and excretion of chemicals (also called pharmacokinetics).

Trophic Levels: A functional classification of taxa within a community that is based on feeding relationships (e.g., aquatic and terrestrial green plants make up the first trophic level and herbivores make up the second).

WATEQ4F model: Program model for calculating speciation of major, trace, and redox elements in natural waters.

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